

CLAIMS

1. A percussion drill bit for percussive drilling in a formation, comprising:

- (a) a bit head for percussive impact against the formation;
- (b) at least a first plurality of first inserts and a second plurality of second inserts extending from the bit head;
- (c) each of the first inserts having a first base portion mounted to the bit head and a first exposed portion extending from the bit head, *that is not superhard* the first exposed portion having a first profile;
- (d) each of the second inserts having a second base portion mounted to the bit head and a second exposed portion extending from the bit head, each of the second exposed portions having a second profile that is appreciably different from the first profile of the first exposed portion, at least some of the second exposed portions enhanced with a superhard material.

2. The drill bit of Claim 1 wherein the plurality of first exposed portions and the plurality of second exposed portions are generally the same geometric shape with one of the pluralities of first and second exposed portions appreciably larger than the other.

3. The drill bit of Claim 2 wherein the second exposed portions are proportionally larger than the first exposed portions.

4. The drill bit of Claim 1 wherein the first exposed portions are generally hemispherical.

5. The drill bit of Claim 4 wherein the second exposed portions are generally hemispherical and the radius of curvature of the second exposed portions is appreciably larger than the radius of curvature of the first exposed portions.
6. The drill bit of Claim 1 wherein the first base portions and the second base portions are generally cylindrical and the diameter of the second base portions is larger than the diameter of the first base portions.
7. The drill bit of Claim 6 wherein the diameter of the second base portions is larger than the diameter of the first base portions by at least ~~about~~ 3 mm. 112
8. The drill bit of Claim 6 wherein the diameter of the first base portions is about 19mm.
9. The drill bit of Claim 6 wherein the diameter of the second base portions is about 22mm.
10. The drill bit of Claim 6 wherein the diameter of the second base portions is about 15% larger than the diameter of the first base portions.
11. The drill bit of Claim 6 wherein the area of the cross-section of the second base portions is at least about 97 sq. mm. larger than the area of the cross-section of the first base portions.
12. The drill bit of Claim 1 wherein the first and second base portions are that portion of the first and second inserts that are gripped by the bit head and the first and second exposed portions are the remainder of the first and second inserts, the height of the second exposed portions along their insert

axis longer than the height of the first exposed portions along their insert axis.

13. The drill bit of Claim 1 wherein the standoff of the second inserts is larger than the standoff of the first inserts.

5 14. The drill bit of Claim 1 wherein the second profiles are different from the first profiles such that the superhard material on the second exposed portions better resists failure than if the superhard material were on the first exposed portions.

10 15. The drill bit of Claim 1 wherein the first exposed portions are enhanced with a superhard material.

16. The drill bit of Claim 1 wherein the second exposed portions are enhanced by having a layer of the superhard material over at least a portion thereof.

17. The drill bit of Claim 1 wherein the superhard material is comprised of polycrystalline diamond.

15 18. The drill bit of Claim 1 wherein the bit head has a periphery with a gage row having at least some of the second inserts located therein.

19. The drill bit of Claim 18 wherein the gage row further comprises at least some of the first inserts.

20 20. The drill bit of Claim 18 wherein the gage row only contains second inserts.

21. The drill bit of Claim 18 wherein some of the second inserts are located on the bit head radially inward of the gage row.

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22. The drill bit of Claim 1 wherein the bit head defines a first plurality of first cavities in which the first plurality of first inserts are disposed, and a second plurality of second cavities in which the second plurality of second inserts are disposed, the depth of the second cavities is greater than the depth of the first cavities so as to reduce the likelihood of internal cracking of the bit head between bottom surface/corners of the first cavities and the second cavities.
23. The drill bit of Claim 1 wherein the second profiles are different from the first profiles such that the second inserts better resist irregular side impact loading than the first inserts.
24. The drill bit of Claim 1 wherein the second profiles are different from the first profiles such that the second inserts generally penetrate the formation shallower than the first inserts during drilling.
25. The drill bit of Claim 1 wherein the second profiles are different from the first profiles such that upon rotation of the bit during drilling, the second inserts advance across the formation with less resistance than the first inserts.

Sub 26. A percussion drill bit for percussive drilling in a formation, comprising:

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- (a) a bit head for percussive impact against the formation;
- (b) at least a first plurality of first inserts and a second plurality of second inserts extending from the bit head;
- (c) each of the first inserts having a first base portion mounted to the bit head and a first exposed portion, *that is not superhard* extending from the bit head, the first exposed portion generally having a radius of curvature;
- (d) each of the second inserts having a second base portion mounted to the bit head and a second exposed portion extending from the bit head, each of the second exposed portions generally having a radius of curvature that is appreciably larger than the radius of curvature of the first exposed portion, at least some of the second exposed portions enhanced with a superhard material.

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27. The drill bit of Claim 26 wherein the first exposed portions are generally proportional to the second exposed portions.

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28. The drill bit of Claim 26 wherein the first exposed portion is generally hemispherical.

29. The drill bit of Claim 28 wherein the second exposed portion is generally hemispherical.

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30. The drill bit of Claim 26 wherein the first base portion and the second base portion are generally cylindrical and the diameter of the second base portion is appreciably larger than the diameter of the first base portion.

31. The drill bit of Claim 30 wherein the diameter of the second base portion is larger than the diameter of the first base portion by at least ~~about~~ 3 mm.
32. The drill bit of Claim 30 wherein the diameter of the first base portion is about 19mm.
33. The drill bit of Claim 30 wherein the diameter of the second base portion is about 22mm.
34. The drill bit of Claim 30 wherein the diameter of the second base portion is about 15% larger than the diameter of the first base portion.
35. The drill bit of Claim 30 wherein the area of the cross-section of the second base portion is at least about 97 sq. mm. larger than the area of the cross-section of the first base portion.
36. The drill bit of Claim 26 wherein the first and second base portions are that portion of the first and second inserts that are gripped by the bit head and the first and second exposed portions are the remainder of the first and second inserts, the height of the second exposed portions along their insert axis longer than the height of the first exposed portions along their insert axis.
37. The drill bit of Claim 26 wherein the standoff of the second inserts is larger than the standoff of the first inserts.
38. The drill bit of Claim 26 wherein the radius of curvature of the second exposed portion is larger than the radius of curvature of the first exposed portions such that the superhard material on the second exposed portions

better resists failure than if the superhard material were on the first exposed portions.

39. The drill bit of Claim 26 wherein the first exposed portion is enhanced with a superhard material.

40. The drill bit of Claim 26 wherein the second exposed portion is enhanced by having a layer of the superhard material over at least a portion thereof.

41. The drill bit of Claim 26 wherein the superhard material is comprised of polycrystalline diamond.

42. The drill bit of Claim 26 wherein the bit head has a periphery with a gage row having at least some of the second inserts located therein.

43. The drill bit of Claim 42 wherein the gage row further comprises at least some of the first inserts.

44. The drill bit of Claim 42 wherein the gage row only contains second inserts.

45. The drill bit of Claim 42 wherein some of the second inserts are located on the bit head radially inward of the gage row.

46. The drill bit of Claim 26 wherein the bit head defines a first plurality of first cavities in which the first plurality of first inserts are disposed, and a second plurality of second cavities in which the second plurality of second inserts are disposed, the depth of the second cavities is greater than the depth of the first cavities so as to reduce the likelihood of internal cracking of the bit head between bottom surface corners of the first cavities and the second cavities.

47. The drill bit of Claim 26 wherein the radius of curvature of the second exposed portions is larger than the radius of curvature of the first exposed portions such that the second inserts better resist irregular side impact loading than the first inserts.

5 48. The drill bit of Claim 26 wherein the radius of curvature of the second exposed portions is larger than the radius of curvature of the first exposed portions such that the second inserts generally penetrate the formation shallower than the first inserts during drilling.

10 49. The drill bit of Claim 26 wherein the radius of curvature of the second exposed portions is larger than the radius of curvature of the first exposed portions such that upon rotation of the bit during drilling, the second inserts advance across the formation with less resistance than the first inserts.

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50. A percussion drill bit for percussive drilling in a formation, comprising:

- (a) a bit head for percussive impact against the formation;
- (b) at least a first plurality of first inserts and a second plurality of second inserts extending from the bit head;
- (c) each of the first inserts having a first base portion mounted to the bit head and a first exposed portion extending from the bit head, each of the first base portions being generally cylindrical with a diameter; *that is not superhard*
- (d) each of the second inserts having a second base portion mounted to the bit head and a second exposed portion extending from the bit head, each of the second base portions being generally being generally cylindrical with a diameter that is appreciably larger than the diameter of the first base portion, at least some of the second exposed portions enhanced with a superhard material.

51. The drill bit of Claim 50 wherein the first exposed portions are generally proportional to the second exposed portions.

52. The drill bit of Claim 50 wherein the first exposed portions are generally hemispherical.

53. The drill bit of Claim 52 wherein the second exposed portions are generally hemispherical.

54. The drill bit of Claim 50 wherein the diameter of the second base portions is larger than the diameter of the first base portions by at least about 3 mm.

55. The drill bit of Claim 50 wherein the diameter of the first base portions is about 19mm.

56. The drill bit of Claim 54 wherein the diameter of the second base portions is about 22mm.
57. The drill bit of Claim 50 wherein the diameter of the second base portions is about 15% larger than the diameter of the first base portions.
58. The drill bit of Claim 50 wherein the area of the cross-section of the second base portions is at least about 97 sq. mm. larger than the area of the cross-section of the first base portions.
59. The drill bit of Claim 50 wherein the first and second base portions are that portion of the first and second inserts that are gripped by the bit head and the first and second exposed portions are the remainder of the first and second inserts, the height of the second exposed portions along their insert axis longer than the height of the first exposed portions along their insert axis.
60. The drill bit of Claim 50 wherein the standoff of the second inserts is larger than the standoff of the first inserts.
61. The drill bit of Claim 50 wherein the first exposed portions are enhanced with a superhard material.
62. The drill bit of Claim 50 wherein the second exposed portions are enhanced by having a layer of the superhard material over at least a portion thereof.
63. The drill bit of Claim 50 wherein the superhard material is polycrystalline diamond.

64. The drill bit of Claim 50 wherein the bit head has a periphery with a gage row having at least some of the second inserts located therein.
65. The drill bit of Claim 64 wherein the gage row further comprises at least some of the first inserts.
- 5 66. The drill bit of Claim 64 wherein the gage row only contains second inserts.
67. The drill bit of Claim 64 wherein some of the second inserts are located on the bit head radially inward of the gage row.
- 10 68. The drill bit of Claim 50 wherein the bit head defines a first plurality of first cavities in which the first plurality of first inserts are disposed, and a second plurality of second cavities in which the second plurality of second inserts are disposed, the depth of the second cavities is greater than the depth of the first cavities so as to reduce the likelihood of internal cracking of the bit head between bottom surface corners of the first cavities and the
- 15 second cavities.

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